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13 ABSTRACT (Maximum 200 words)

Broadband electromagnetic field detection and monitoring systems have been investigated in the 30 MHz – 18 GHz frequency range. To minimize the intrusivness of these field monitoring probes, fiber optic and electro-optic techniques have been employed to transmit the detected broadband information to a remote processing station. These short-haul (< 1 km) wideband fiber optic links possess no electrical or optical amplifiers to boost the detected antenna signal which increases the importance of constructing low noise figure transmission links. Both directly modulated (current modulation of injection laser diode) and externally modulated (voltage modulation of optical waveguide modulator) wideband optical systems have been developed.

Results of anechoic chamber tests of several electromagnetic field detection systems will be presented. The performance of a 2 – 18 GHz externally modulated system will be presented which consists of a broadband cavity-backed spiral antenna, an optical waveguide modulator, a 1.32 μm Nd:YAG solid state laser, single-mode optical fiber, and a high-speed photodiode. Operation with both III–V semiconductor based and lithium niobate based optical waveguide modulators have been investigated and compared for the externally modulated system. An rms electric field sensitivity of 15 μV/m and a spurious free dynamic range of 102 dB in a 1 Hz resolution bandwidth have been measured with this 2 – 18 GHz field detection system. The performance of a 30 MHz – 500 MHz directly modulated system will also be presented which consists of a broadband VHF/UHF antenna, a laser diode, single-mode optical fiber, and a photodiode. For each field sensing system, the frequency response, electromagnetic field sensitivity, dynamic range, as well as environmental stability are reported. The advantages and disadvantages of both the directly modulated and externally modulated electro-optic field detection systems will be discussed.

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